Geochemical and petrographical characteristics of amphibolites in Namaqua Belt, and Damara Belt, southern parts of Africa

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Field survey was conducted in March 2004 at the amphibolite terranes of the Proterozoic Namaqua Belt, South Africa and at the Pan African Damara Belt, Namibia. We collected amphibolites and related rocks from the Upington sequence of the Areachap Group, at a northwestern part of the Namaqua Belt. Amphibolites were also examined at the Matchless Amphibolite Member of the Damara Belt. We examined geochemical and petrographical characteristics of the amphibolites and estimate their igneous protoliths.

{Namaqua Belt}

About 300km-wide Namaqualand Metamorphic Complex (NMC) is parts of the Namaqua-Natal mobile belt, distributed from the southern part of the Namibia to the west coast of South Africa. In the western part of NMC, there are excellent outcrops of low-pressure amphibolite-facies mafic rocks of the Bushmanland Group and the granulite-facies rocks of Marydale Group. Amphibolites of the Upington sequence of the Areachap Group are exposed along the east part of NMC.

The Upington amphibolites consist mainly of hornblende, plagioclase (An58), epidote, and small amounts of quartz, chlorite, sphene, and magnetite. Their whole rock chemical compositions are characterized by high LIL and low HSF elements, similar to the middle- to high-K tholeiitic basalts reported from various localities of the modern day oceanic arcs. The amphibolites are closely associated with high-Al tonalitic rocks. The igneous protoliths of Upington amphibolites are interpreted to be island arc tholeiitic basalt formed at plate convergent margin. The Upington sequence of the Areachap Group represents middle Proterozoic juvenile arc crust accreted to the Kalahari craton. The Areachap Group is compared to the Tugela amphibolite terrane, Natal belt.

{Damara Belt}

About 400km-wide Damara Belt is distributed at a southwestern part of Namibia. The Damara Belt was developed between the Kalahari craton and the Congo craton. It extends northeastwards and at north it joins to the Katangan Zambezi Belt. In the southern parts of Damara Belt, the Matchless Amphibolite Member (MAM) outcrops as narrow belts with 1-3km wide. The MAM consists of north and south units. The two units differ widely in metamorphic grade and deformation structure (Schneider and Seegar, 1993). The MAM is over and underlain by terrigenous sedimentary rocks. The tectonic relationships between the MAM and the terrigeneous sedimentary rocks are not well understood. In this study, we examined petrographical and geochemical features of the MAM amphibolites to identify their igneous protoliths

The amphibolites of north unit consist mainly of hornblende, clinopyroxene, plagioclase (An20-30), with small amounts of epidote, biotite, chlorite, iron oxides and sphene, while those of the South unit consist mainly of hornblende, plagioclase (An80-90) and iron oxides. The amphibolites in the Windhoek area have strong foliation and metamorphosed up to the epidote-amphibolite facies. The amphibolites obtained from the Gorob area closely associates with garnet-staurolite-bearing metasedimentary rocks. Metamorphic grade in the north unit is higher than that in the south unit. Whole rock compositions of amphibolites in both units are comparable to those of low-K tholeiitic basalt. Their major and trace element abundance are similar to the normal MORB. The MAM has been considered to be the ancient ocean crust emplaced during the continental collision at Pan-African age (Miller, 1983). The MAM amphibolites are interpreted to be metamorphosed oceanic crust formed at the Pan African period.